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THE BERTHELOT CENTENARY AND THE RESULTING INTERNATIONAL EFFORTS TO ADVANCE CHEMISTRY[1]

IN January last I had the pleasure of describing before the Chemical Society of Washington the celebration of the centenary of Marcelin Berthelot held in Paris from October 24 to 26 of last year. These remarks have been published in SCIENCE (Feb. 17, 1928) and possibly have been read by some of you.

Through the kindness of the French ambassador and M. Maurice Léon I am able to show you to-night a photographic record of the event, which will certainly give you a more vivid impression of it than I was able to convey by words alone to the chemists of Washington. Thanks to this pictorial presentation it will not be necessary for me to review again the details of the various ceremonies and more attention can be given to other aspects of the event.

Considering the celebration in its entirety there is no question but that it was the most magnificent tribute to chemistry but has ever been organized. More than fifty nations of the world sent distinguished chemists or governmental representatives. The president and entire government of France as well as the ministers and ambassadors of many other nations participated. Chemistry was extolled more highly than ever before. Judging by the space devoted to it by the newspapers the celebration attracted the attention of the general public to an extraordinary degree.

The gathering was noteworthy in being the first since the great war at which the chemists of the enemy nations have met together under such amicable circumstances. An especial effort was made to re-establish cordial relations between all, and the evidence of success in this direction was unmistakable.

The assemblage was unusual in that no other attraction than friendly regard drew the participants together. It is true that in the preceding week a program of chemical interest was provided by the Société de Chimie Industrielle, but at the Berthelot celebration nothing was presented other than discourses on Berthelot and the plan to perpetuate his ideals in regard to cooperation among scientists.

[1] Address delivered before the joint meeting of chemical societies at the Chemists' Club, New York, April 6, 1928.

As expressed by Berthelot science is a collective endeavor and owes its progress to the efforts of workers in all countries. It is truly international, and of all men scientists should be most interested in promoting friendly international relations. This was undoubtedly the keynote of the celebration and in emphasizing it French chemists demonstrated their outstanding interest in cooperative efforts to advance chemistry.

The desirability of intimate contact between those engaged in chemistry does not need to be emphasized. It is true that we may become acquainted with other chemists through their publications, and to many this is sufficient, but to others there is nothing so stimulating as personal intercourse with those interested in like problems. Any means which facilitates this contact may be expected to advance chemistry. This is believed by its sponsors to be one of the missions of La Maison de la Chimie.

The Chemists' Club of New York, although a local undertaking, has become a most powerful agency for the advancement of chemistry. It offers membership to chemists outside of New York and thus extends its field of usefulness. The Maison de la Chimie which will be erected in Paris will serve primarily those in its immediate vicinity, but it will also do for the chemists of the adjoining and other countries what the Chemists' Club of New York does for those of us who reside in other parts of the United States.

There is this difference between the two undertakings—whereas those who founded the Chemists' Club probably did not realize what an important factor for the advancement of chemistry they were inaugurating, the sponsors of La Maison de la Chimie are knowingly setting out to establish an international center for this purpose. Thus they have the advantage of a predetermined plan and a definite goal.

It can not be denied that such a center located in Paris will be of great service to the chemists of a large group of European countries. It is of course not so certain that many American chemists will be directly benefited by it. This, however, should not be a reason for the indifference with which the project has been received in our country. A more correct explanation of the attitude of American chemists is undoubtedly the great distance which separates us from Europe and the huge task in hand of developing chemistry in this country. We are captivated by our own affairs and will not allow our attention to be distracted by circumstances which we believe do not directly concern us.

There is, however, another reason which accounts for some of the criticism expressed by our society at Detroit. It was the solicitation by the French government of collaboration in the undertaking. We naturally question any governmental participation in scientific matters because we feel that anything having a political flavor can not be above suspicion. This, however, is an attitude which is peculiar to our country. In practically all others, it is the government which directly supports science. In France, for example, all the leading men of science in their capacity as professors in the universities or directors of institutions are government employees and every action they take in international affairs is with the financial and moral support of their government.

The movement for an international Maison de la Chimie was initiated by the chemists of France, but its realization would have been impossible without governmental aid. The reason it obtained such full support from the French government was that the prime minister and many of his associates are themselves scientists of the highest standing and have the very fullest appreciation of the benefits resulting from the progress of science. Berthelot was in his time minister of public instruction and Herriot, the present minister, occupied a prominent place in the ceremonies planned in honor of his predecessor in office. The close relation which exists between the governments and science in other countries was also shown by the number of ministers from other nations who participated in the Berthelot celebration. Finally, the small countries and colonies which contributed to the movement could have done so only through their governments. As with all other countries, the appeal to the United States to join in this movement was addressed to our government. It was the natural method, and if an exception had been made in our case and the request addressed directly to our society the action would have been considered, from their point of view, as one of disrespect to the United States government.

The fact that the leaders of our government are not men of science and that there is not a closer relation between science and government in the United States is regrettable. It is to be hoped that the organized effort to popularize science, being made by Science Service and the American Chemical Society (A. C. S.) News Service, may eventually arouse our government to greater interest in its benefits.

In another respect, however, we are particularly fortunate. It is that in the United States we have a single language and no political barriers between different sections of our great country. These handicaps exist in Europe, and the cooperation of the smaller groups of chemists in the various countries can be effected only by overcoming much greater resistance than oppose our efforts in America. It is this situation which makes desirable the concerted effort represented by La Maison de la Chimie. Aside from the countries in which the English and German

languages are used there are many in which French is either the native or preferred language. These Latin countries are sorely in need of coordination of their efforts in respect to the dissemination of chemical literature. A central clearing house which can serve them in the way chemists are served by the organizations in Germany, England and America may be expected to facilitate greatly their contribution to the advancement of science. The International Office of Chemistry which will be given shelter in La Maison de la Chimie will undoubtedly perform an incalculable service to a large number of chemists in many different countries.

There is, however, a very difficult problem which confronts those interested in the establishment of this new project. Beginning now after such an extensive literature of chemistry has accumulated, the collection of a considerable part of it is a costly and laborious task. Even to establish a comprehensive French abstract journal for current contributions is a great undertaking, and with the present acceleration in the output of chemical publications necessarily becomes more and more difficult.

While talking to M. Gerard some months ago he told me of these problems and gave me a hint of a possible means to solve them. Although the solution he contemplated would necessarily be an experiment it would be one which the rapid increase in scientific literature is certain to make necessary sooner or later. Any improvement in the distribution of scientific literature is certainly desirable and the results of the experiment to be made by the International Office of Chemistry will be awaited with the greatest interest.

The plan contemplates the reproduction of printed chemical articles by a cinematographic process. The pages will be photographed upon a film and this sent to the user who will project it page by page before him on his desk and to such an enlargement as best suits his vision. The disadvantages to some resulting from the use of small type by certain journals will thus be avoided. Abstracts which attempt to give the substance of a paper will not be necessary, since the entire article may be sent out for a cost which it is expected will be no greater than that now required for preparing, editing, printing and distributing an abstract journal.

In order to acquaint chemists with the current articles as they appear a card catalogue system will be employed. The cards will be efficiently classified and describe only the scope of the paper. Each member will receive cards for the particular branches of chemistry in which he is interested and will select from these the papers of which he desires photographic copies.

This will be in effect a new kind of bibliographic service, and its success will of course depend upon the ingenuity displayed in perfecting the photographic apparatus required and the efficiency attained in the preparation and classification of the cards covering the current chemical literature.

The service which such a system will render to chemists of those countries in which the general distribution of chemical literature has not yet been developed may easily be imagined. The necessity for maintaining large libraries of chemical periodicals in each country will be greatly diminished and more money can be spent for compendia and text-books. The waste due to requiring those who subscribe to chemical journals to purchase a great quantity of material which they do not use and the necessity for condensing papers to an excessive degree will be largely eliminated. Each worker under the new plan will accumulate only that which directly concerns his own research activities.

This is the germ of an idea which will no doubt be considered by many to be fantastic, especially since it is contrary to the principle of mass production developed in our own society. Our three journals can be distributed to all our members cheaper than a smaller edition of each could be sent to those who would select only one of the three. What, then, would happen if eventually the edition of our publications should be reduced to the small number of copies required to supply libraries and distributing centers? It is difficult to predict, but it is easy to imagine that multigraphing processes will be so highly developed by that time that the printing of journals devoted solely to research will not be necessary.

The project of La Maison de la Chimie and of the International Office of Chemistry must be looked upon as an experiment in the cooperative advancement of world chemistry. The exact method by which this is to be accomplished can not be predicted, but that this is the sole aim of the sponsors of the movements no fair-minded person can doubt.

American good-will has made itself felt throughout the world. Our great philanthropists who have founded such international projects as those connected with the name of Rockefeller desire to improve conditions universally, both as regards health and learning. A larger portion of their funds are expended outside of this country than within it. Surely the chemists of the United States are not less magnanimous in regard to the advancement of our science and have nothing but good wishes for the earnest efforts of every one who desires to make chemistry a more powerful factor in world progress.

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RAINFALL AND RUN-OFF

IN a paper entitled "The Origin of Springs and Rivers—an Historical Review," presented by the writer at the annual meeting of the Geological Society of America held in Cleveland in December, 1927, it was shown that the statement of Aristotle to the effect that the rainfall on the earth's surface was quite insufficient to supply the amount of water carried off by the rivers and that some other contributory source of water must be found was accepted as correct by practically every writer on this subject down to the seventeenth century of the Christian era.

The first demonstration that this statement was not correct and that the rainfall is not only sufficient but much more than sufficient to supply the rivers with all their water is contained in a little book which was published in Paris in 1674 under the title "De L'origine des Fontaines." This work of duodecimo size and containing 353 pages appeared anonymously.

In the Philosophical Transactions of the Royal Society of London for A. D. 1674, p. 447, there appears (without signature) a short article which commences as follows: "A Particular Account given by an anonymous French Author in his book on the Origin of Fountains printed in Paris 1674 to show that the Rain and Snow waters are sufficient to make Fountains and Rivers run perpetually."

The early numbers of the Philosophical Transactions having run out of print, they were reprinted in an abbreviated form in 1731, the order for their publication being signed by Sir Isaac Newton as president of the society at that time.

A second abridged reprint of these early volumes was issued later, the first volume appearing in 1809. In both of these reprints the "Particular Account" above referred to reappeared, that in the latter being in a somewhat expanded form, and no mention of the name of the author of the book is made either in the original edition or in the first reprint of the Transactions. In the second reprint, however, the abstract is said to be that of *Papin's* book on the "Origin of Fountains" (Paris, 1674).

This statement was accepted as authoritative in fixing the authorship of this important little book and in his paper presented to the Geological Society of America the writer gave Papin the credit for having written it.

Papin as a matter of fact had, in a paper published in 1647, put forward the directly opposite opinion, but from the evidence referred to above it was supposed that in his latter years he had, after a detailed study of the subject, changed his views. The present writer had not been able anywhere to find a copy of the book in question before the presentation of his paper to the Geological Society of America, but since that time a copy has come into his hands through one of the dealers in old books in Europe.

An examination of the text of the book gives no clue to its authorship, but on the title page there has been written in ink by an unknown hand the words "par pierre Perrault."

On consulting the "Biographie Générale depuis les Temps les plus reculés jusqu'a nos Jours—Paris 1862" it was found that Pierre Perrault (whose name in the paper is mentioned as an associate of De la Hire and Mariotte), who was born about 1608 and died in 1680, is stated to have written a book having the title given above and which was published in Paris in 1674.

On comparing the abstracts in the Philosophical Transactions with the work itself it is clearly seen that this book which was attributed to Papin was really written by *Pierre Perrault*, to whom therefore belongs the honor of having discovered and established one of the fundamental facts of geology, namely, that the rivers of the earth derive their supplies of water from the rain which falls upon the earth's surface and not from the earth's interior or some other quaint source as held by earlier writers.

Pierre Perrault, who made this very important contribution to geological science, was not a member of the French Academy but a lawyer and man of affairs who took an interest in science, and who is therefore a member of that group of amateur workers who, like Clifton Sorby and others, have from time to time rendered such important services to science. It is a matter of regret that in certain other directions his activities were not viewed so favorably by his contemporaries, for it is recorded in the biographical sketch to which reference has been made that—"il fit ses études en droit et après avoir occupé quelques emplois secondaires dans l'administration acheta la charge du receveur général des finances de la généralité de Paris charge que Colbert, son ami cependant, le força de quitter pour avoir emprunté à sa caisse quelques sommes dont il avait besoin pour satisfaire d'avides creanciers."

Another point which may be worthy of mention in this connection is that in the abstract of Perrault's book which appears in the original edition of the Philosophical Transactions and which is reproduced without substantial change in both sets of the abstracts which appeared later, certain figures of rainfall and run-off in the district of the Upper Seine taken from Perrault are presented, upon which he based his conclusion that the rainfall of that district was six times as great as the run-off. These figures, however, do not bear out this result. This fact remained unnoticed until the publication of the second

set of abstracts, when the editor remarked that some mistake must have been made in the numbers. On tracing this back to Perrault's book it is found that the abstracter for the original edition of the Philosophical Transactions, and whose abstract was copied by the others, confused the words "vingt quatre" (24) and "quatre vingt" (80), the amounts in the book being given in words and not in numerals. The amount of rainfall on the area selected for study is actually given by Perrault as 224,899,942 "muids" —and not "a little over 280 million" as stated by the abstracter. With this alteration the result given by Perrault—namely, that the run-off is one sixth of the rainfall—is seen to be correct.

In 1686 a book entitled "Traité du Mouvement des Eaux et des autres corps Fluides," by M. Mariotte, was published in Paris. This was twelve years after the appearance of Perrault's book. This work of Mariotte's was "mis en lumière" after the author's death by M. de la Hire, Professor of Mathematics, and, like Mariotte, a Member of the Royal Academy of Sciences of Paris. Mariotte was according to his biographer the first man in France to bring to the study of the science of Physics "un esprit d'observation et de doubt . . . si necessaire à ceux qui interrogent la nature."

In this book the question of the Origin of Springs is taken up in the Second Discourse. After referring to the "author of the book entitled on the Origin of Fountains" and his work, but without any mention of his name, Mariotte sets forth the results of certain measurements of the rainfall about Dijon which he had caused to be made, as well as measurements of the run-off of the Seine taken at the Pont Rouge in Paris. The annual rainfall according to these measurements was about seventeen inches. Taking it as fifteen inches, Mariotte calculated that the run-off was somewhat less than one sixth of the rainfall and that if taken as eighteen inches it would amount to one eighth of the rainfall.

In this way Perrault's work was confirmed by another of that brilliant group of men who were at work in Paris about this time.

The paper read before the Geological Society of America at the Cleveland meeting appears only in the form of an abstract in the Bulletin of the Society but will be printed *in extenso* in the Festband which is being issued by the University of Helsingfors in honor of Professor Sederholm and which is now in press. The present note will serve to correct the statement in both the abstract and in the extended paper which gives to Papin instead of to Perrault the credit for the important discovery made by the latter

FRANK D. ADAMS

McGILL UNIVERSITY

EDWARD SANDFORD BURGESS

JANUARY 19, 1855—FEBRUARY 23, 1928

ALL too few are men of Louis Agassiz type, who combine a devotion to scholarly research with a marked gift for imparting to beginners their own zest for scientific pursuits. Such a teacher was Dr. Edward Sandford Burgess, for thirty years professor and head of the department of biological sciences (and for a time acting president) of Hunter College, New York City. A man of rare charm and unassuming manner, he chose always to elucidate, never to impress; gentle, selfless, kindly, he gave unstintingly of his time and energy to his students and to his chosen fields of work.

Dr. Burgess was not only a scientist; he had a wide and eager knowledge of many subjects and an especially deep appreciation of the finer things in the literature and art of many lands. His special spheres of labor were in botany and anthropology. He was a recognized authority on the genus Aster and on the history of botany, his major publications being a "History of Pre-Clusian Botany" (1902) and "Species and Variations of Biotian Asters" (1906). Among his other published works are: "The Chautauqua Flora" (1877); "Botanical Genera, Tribes and Families," in the Century dictionary, M to Z, 1891; "The Asters of the Northern United States" (with Dr. N. L. Britton, in Britton and Brown's "Illustrated Flora"), 1898; "The Asters of the Southern United States" (in Small's "Southeastern Flora"), 1903; "The Old South Road at Gay Head" (Duke's County, Mass., Historical Society Publications, Vol. 1, No. 4, 1926); a volume of poems.

During later years Dr. Burgess devoted much time to anthropology and taught this subject at Hunter College. Among his unpublished manuscripts are two extensive ones, entitled: "A Look at the Development of Man" and "A Series of Lectures on Anthropology." There are several genealogical and historical researches, especially on Indian lore of Martha's Vineyard.

Professor Burgess was a grandson of Dr. Jacob Burgess, who moved from Berkshire County, Massachusetts, to Silver Creek, New York, in 1811. His father, the Reverend Dr. Chalon Burgess, was long the pastor of the Presbyterian church of this place. His mother was Emma Johnston, daughter of the Reverend Charles Johnston, of Ovid, Seneca County, N. Y. Edward Burgess was born in Little Valley, Cattaraugus County, but his boyhood was spent in Panama, Chautauqua County. He was graduated from the state normal school of Fredonia, and, with distinction, from Hamilton College in 1879. For two years he held a graduate fellowship in Greek at Johns

Hopkins under the eminent Greek scholar, Dr. Gildersleeve. In 1899 he received from Columbia University the degree of doctor of philosophy, and in 1904 from Hamilton College that of doctor of science.

From 1882 to 1895 (when he became professor of natural science at Hunter College) Dr. Burgess taught botany in the Washington, D. C., high schools and from 1880 to 1895 at the Martha's Vineyard summer institute. He was instructor at Johns Hopkins in 1885. He was a member of the Phi Beta Kappa, the American Association for the Advancement of Science, the New York Academy of Sciences, the American Anthropological Association (a founder), the Society of American Folk-lore, the Century Club of New York, the Torrey Botanical Club, of which he was president, 1912–13, the New York Botanical Garden Corporation (a director, 1912–13).

Dr. Burgess's friends will cherish most the memory of him in his Yonkers home, Sweetbriarside. His marriage to Irene S. Hamilton, of Fredonia, N. Y., was one of rare companionship of spirit. Their garden, with its Shakespeare plot, its Wordsworth bed, its Keats corner, its Hellenica, its plants of western New York, its lily pool filled with native and exotic lilies, its dozen varieties of hybrid sweetbriars, its eighty or more different conifers, its wealth of tulips and roses, has been a delight to all flower lovers and is the expression of the lifelong devotion of the owners.

Dr. Burgess was modern in his conceptions of biology, yet from training and conviction he was deeply religious. Of the views of others, who differed, he was very tolerant: "Truth can not contradict itself," he was wont to say. His reverent attitude toward nature is reminiscent of two such different masters as Charles Darwin and Louis Agassiz. More accurately, Dr. Burgess recalls J. S. Henslow, of Cambridge, the wise professor of botany "who knew every branch of science," the beloved mentor with whom Darwin took long walks, until he became known as "the man who walks with Henslow."

A portion of Darwin's tribute to Henslow, as Romanes has pointed out, reflects the character of Darwin, but it is also an excellent likeness of Edward Burgess.

> Nothing could be more simple, cordial, and unpretending than the encouragement which he afforded to all young naturalists. I soon became intimate with him, for he had a remarkable power of making the young feel completely at ease with him; though we were all awe-struck with the amount of his knowledge. Before I saw him, I heard one young man sum up his attainments by simply saying that he knew everything. When I reflect how immediately we felt at perfect ease with a man older, and in every way so immensely our superior, I think it was as much owing to the transparent sincerity of his character as to his kindness of heart; and, perhaps, even still more, to a highly remarkable absence in him of all self-consciousness. One perceived at once that he never thought of his own varied knowledge or clear intellect, but solely on the subject in hand. Another charm, which must have struck every one, was that his manner to old and distinguished persons and to the youngest student was exactly the same: and to all he showed the same winning courtesy. In short, no man could be better informed to win the entire confidence of the young, and to encourage them in their pursuits. It always struck me that his mind could not be even touched by any paltry feeling of vanity, envy, or jealousy. With all this equability of temper and remarkable benevolence, there was no insipidity of character. A man must have been blind not to have perceived that beneath this placid exterior there was a vigorous and determined will. When principle came into play, no power on earth could have turned him one hair's breadth.[1]

Darwin adds, "I owe more than I can express to this excellent man."

In our strenuous era of high pressure research, when beginners emerge from courses in test-tube biology—*à la mode* and labeled "modern"—with a somewhat cynical and suspicious attitude toward Nature in her visible forms, it is perhaps permitted one to reflect upon the passing of the fine art of instilling an appreciation of natural history, and to wonder if youngsters of the future will experience the intellectual high adventure which has been the good fortune of those who have walked with Henslow, Agassiz, Jordan, Dudley, Burgess, Comstock and many another of the past or passing generation, too numerous to name.

WALTER K. FISHER

HOPKINS MARINE STATION

SCIENTIFIC EVENTS

THE OXFORD EXPEDITION TO GREENLAND

THE Godthaab district of Greenland has been chosen as the scene of the Oxford University Greenland expedition of 1928, which has been initiated by the Oxford University Exploration Club, and has for its objects the continuation of the biological work begun in the Oxford Arctic expeditions of 1921, 1923 and 1924. A correspondent of the London *Times* writes that this area has been chosen as representing the region (to which the barren lands of Canada belong) where biological surveys have only just passed through their preliminary stages. Here a comparative survey of the wild life and the conditions con-

[1] "Life and Letters of Charles Darwin." Edited by Francis Darwin, Vol. 1, p. 186.

trolling it can be worked out by the ornithologist, the botanist and entomologist of the expedition, as a contribution towards researches in economic zoology and botany, which are necessary for the solution of important problems of human economy.

The study of malaria, of crop pests, of the means of developing and controlling the natural resources of countries, requires a clear understanding of the laws governing the interrelations of animals of all kinds and especially the regulation of their numbers. The data are not yet available for a complete understanding of these problems, but a preliminary contribution to them can be made through the working out of principles among a limited class of life in a place which the short northern season, the small number of species involved, and the absence of human interference make particularly favorable for the purpose.

Dr. T. G. Longstaff has consented to act as the leader of the party, which will consist of eight members. The expedition proceeds under the official authority of the university and with the official support of the Royal Geographical Society. It is assured not only of all facilities from the Danish government, but also of the benefit of the experience of the best Danish naturalists and explorers. The university has formally voted £50 towards the expenses of the expedition and the rest of the funds have been supplied by the members and their friends.

The personnel of the expedition will be as follows:

T. G. Longstaff, naturalist and topographer.
Major R. W. G. Hingston, entomologist.
E. M. Nicholson, ornithologist.
C. G. Trapnell, botanist.
W. G. H. D. Crouch, photographer and quartermaster.
B. D. Nicholson, ornithologist and assistant surveyor.
Sir John Hanham, assistant botanist.
H. P. Hanham, assistant ornithologist.

THE INTERNATIONAL CONGRESS OF AMERICANISTS

ARRANGEMENTS are being made for the meetings of the twenty-third session of the International Congress of Americanists, to be held during the week beginning September 17 in New York. The invitations for the Americanists to meet in New York were extended at the twenty-second session, which was held in Rome in September, 1926, by the American Museum of Natural History, Columbia University, the Brooklyn Museum, the Museum of the American Indian, Heye Foundation, the American Geographical Society, the American Ethnological Society, the New York Academy of Sciences and the Archeological Institute of America.

The headquarters of the congress will be at the American Museum of Natural History, where the opening and closing meetings will be held. During the week there will also be meetings at Columbia University, the Museum of the American Indian, the Heye Foundation and the Brooklyn Museum. Prominent students of American Indian life and related topics will be in attendance from Europe and Latin America. The papers and discussions will deal with aboriginal inhabitants of the Americas, the origin and distribution of their cultures and matters of history, geology and geography bearing on the native populations.

FRANZ BOAS,
Chairman of the Organization Committee
P. E. GODDARD, *Secretary*,
American Museum of Natural History,
New York City

BUILDING PLANS OF THE AMERICAN MUSEUM OF NATURAL HISTORY

PLANS for the construction of nine new sections to the American Museum of Natural History, to be completed by the seventieth anniversary of the institution in 1939, are contained in a report made to the trustees by President Henry Fairfield Osborn. In addition, a new building to be known as the Roosevelt Memorial, costing $3,250,000, is to be erected as a new entrance hall at the intersection of Seventy-ninth Street and Central Park West.

Two of the new wings, the African hall, costing $1,350,000, and the power and service section, costing $900,000, together with the Roosevelt Memorial are to be constructed in the immediate future. The other sections, the building of which will be spread out over the next eleven years, are to be the astronomic hall, to cost $1,689,525; Australian hall, $1,006,549; middle American hall, $2,306,592; south oceanic hall, $1,006,549; lecture amphitheater hall, $2,994,529; preparation and storage hall, $500,000. The complete cost of the new sections and the Roosevelt Memorial will be $15,004,744.

Dr. Osborn gave a *résumé* of the history of the museum since 1869, the year of its founding, and made note of the fact that only $8,390,599.68 had been spent on the institution since that time, and when added to the proposed expenditures will make a grand total of $23,394,343.68 for the nineteen section building as planned.

Dr. Osborn added that since 1902 more than $23,000,000 in gifts and bequests had been received by the museum. In this summary of the history of the institution, the president recalled that in 1869 New York had no museum of any kind, while such institutions flourished in Boston, Philadelphia, Chicago, Washington and in all the European capitals.

The father of President Roosevelt was one of the founders of the American Museum of Natural History, and in December, 1919, a movement was started to create a memorial to honor both father and son. In 1924 the State Legislature appropriated $250,000 to start the project.

NEW BUILDING FOR PLANT INDUSTRY AT THE UNIVERSITY OF MINNESOTA

DR. R. W. THATCHER, president of the Massachusetts Agricultural College, formerly dean of the department of agriculture of the University of Minnesota, has accepted an invitation to deliver the address at the dedicatory exercises of the new plant industry building for agricultural biochemistry at University Farm, St. Paul, on Thursday afternoon, June 7.

The building will be formally presented to the university by President F. B. Snyder, of the board of regents. The address of acceptance will be given by Dean W. C. Coffey. Greetings from the American Chemical Society will be extended by its president, Dr. S. W. Parr, professor emeritus of the University of Illinois. Greetings from the American Association of Cereal Chemists will be voiced by Leslie Olsen, its president and chief chemist of the International Milling Company of Minneapolis. As the association and also the northwest regional group of the American Chemical Society will meet in Minneapolis the same week, it is expected that a body of 400 to 500 chemists will attend the dedication exercises.

The new building, 152 feet in length and 70 feet deep at its maximum, cost with its equipment approximately $250,000. The construction material is cut limestone to the top of the basement, and brick the remainder of the exterior. Reinforced steel concrete was used throughout, with floors of concrete and terrazzo. The floor plans were designed with particular reference to research and teaching facilities.

The basement, which is largely above ground, combines a store room 24 by 42 feet and a laboratory of like proportions for semi-commercial scale experiments. The laboratory is provided with filter presses, vacuum pans and autoclaves. An optical room is used for physical-chemical research with the ultra-microscope and ultra-violet light. A large laboratory is used for cereal chemistry research. Constant temperature rooms are equipped and controlled for low temperature work.

The main floor is essentially a teaching floor, with the addition of offices and private laboratories for two members of the division staff. Two lecture rooms, capable of seating 70 students each, are on this floor. The second floor is a teaching and administration floor, with ample space for the division office and library, and for laboratories for assistants. The third floor contains large laboratories for graduate students who are working on thesis problems, a large room for office and study, offices of staff members and two animal nutrition laboratories.

A nutrition laboratory, 24 by 31 feet, on this floor is used by students working thesis on nutrition problems, where the use of small animals is required. The experiment station projects on vitamins are conducted on this floor.

LECTURES UNDER THE AUSPICES OF THE ASTRONOMICAL SOCIETY OF THE PACIFIC

TWELVE lectures were held during the past season in Southern California under the auspices of the Astronomical Society of the Pacific as follows:

At California Institute of Technology, Pasadena:

Sun Rays in the Service of Man
Dr. C. G. Abbot
Smithsonian Institution

The Exploration of Space
Dr. E. P. Hubble
Mt. Wilson Observatory

Sun-Spots
Dr. S. B. Nicholson
Mt. Wilson Observatory

Stars in Action
Professor A. H. Joy
Mt. Wilson Observatory

The Interior of a Star
Dr. W. S. Adams
Mt. Wilson Observatory

Our Planet Neighbors
Dr. R. G. Aitken
Lick Observatory

At Public Library, Los Angeles:

Beyond the Milky Way
Dr. E. P. Hubble
Mt. Wilson Observatory

The Great Meteor of Central Arizona
Dr. Mars Baumgardt
Southern California Academy of Science

Telescopes
Dr. F. G. Pease
Mt. Wilson Observatory

The Sun
Professor F. Ellerman
Mt. Wilson Observatory

The Solar System
Dr. R. G. Aitken
Lick Observatory

Giant and Dwarf Stars
Dr. F. C. Leonard
University of California at Los Angeles

SCIENTIFIC NOTES AND NEWS

DR. MAX MASON, president of the University of Chicago, previously professor of mathematical physics in the University of Wisconsin, has resigned to accept an appointment as director of the newly created division of Natural Sciences of the Rockefeller Foundation.

THE Rumford medal of the American Academy of Arts and Sciences has been awarded to Dr. Edward L. Nichols, emeritus professor of physics at Cornell University.

DR. JOHN C. MERRIAM, president of the Carnegie Institution of Washington, and Dr. Elihu Thomson, director of the Thomson Research Laboratories of the General Electric Company, will deliver the leading addresses at a banquet at the Hotel Astor, on the occasion of the conferring on May 24 of the gold medal for science of the Society of Arts and Sciences on Mr. Thomas Edison.

PRESENTATION of the seventeenth Willard Gibbs medal of the Chicago section of the American Chemical Society to Dr. W. D. Harkins, of the University of Chicago, will be made at a dinner to be held at Palmer House, Chicago, on May twenty-fifth.

PRESENTATION of a bust of Dr. John Dewey, professor of philosophy in Columbia University, was made to him at the Henry Street Settlement Building, New York, on May 16.

THE Vienna Society of Medicine, on March 23, elected as corresponding member Dr. Francis G. Benedict, director of the nutrition laboratory of the Carnegie Institution of Washington, Boston.

DR. ELVIN C. STAKMAN, professor of plant pathology at the University of Minnesota, has received the Emil Christion Hansen prize, consisting of a gold medal and 2,000 crowns, for his works on the diseases of plants. The prize was handed to the American chargé d'affaires at the legation at Stockholm on May 8 in the absence of Dr. Stakman.

PROFESSOR ALBERT EINSTEIN has been elected an honorary member of the British Physical Society.

THE council of the Royal Anthropological Institute has awarded the Huxley memorial medal for 1929 to Baron Erland Nordenskiöld, of Göteborg. He has also been invited to deliver the Huxley memorial lecture in November of that year.

THE John Hunter Medal in bronze, with the triennial prize of £50, has been awarded by the Royal College of Surgeons of England to Victor Ewings Negus, for his investigations into the comparative anatomy and physiology of the larynx and the anatomy of the bronchi in their relation to surgery.

DR. FRIEDRICH BECKE, professor of mineralogy at the University of Vienna, has been elected a foreign member of the Swedish Academy of Sciences.

DR. WILLIAM STERN, professor of psychology in the University of Hamburg, has been elected a corresponding member of the French Society of Psychology.

SIR WILFRED GRENFELL is to receive the honorary degree of doctor of laws from McGill University at the convocation, May 30. The degree is to be given in recognition of his service to humanity in establishing and maintaining a series of hospitals and nursing homes along the coast of Labrador.

THE awards of the medals of the Royal Geographical Society have been made as follows: The Founder's medal to Dr. T. G. Longstaff, for his discovery of the Siachen Glacier and long-continued geographical work in the Himalaya, and the Patron's medal to Captain G. H. Wilkins, for his many years' systematic work in Polar regions, culminating in his remarkable flight from Point Barrow to Spitsbergen. The Murchison grant to Captain C. J. Morris, for his recent journey in Hunza; the Back grant to Mr. George Binney, for his journey across North-East Land and his successful conduct of the Oxford Expeditions to Spitsbergen; the Cuthbert Peek grant to Mr. H. G. Watkins, in recognition of his leadership of the Cambridge Expedition to Edge Island and to assist him in his proposed expedition to Labrador, and the Gill Memorial to Mr. C. P. Skrine, for his exploration of the Qungur area and his work on Chinese Central Asia.

THE Association to Aid Scientific Research by Women awarded the Ellen Richards research prize of $2,000 at its annual meeting held on April 28 at the Massachusetts Institute of Technology. This prize, awarded for experimental research, was divided equally between Dr. Lisa Meitner, of the University of Berlin, and Madame Ramart-Lucas, of the University of Paris. Dr. Meitner's work has been in physics, especially radio-activity. Madame Ramart-Lucas's field is organic chemistry. Dr. Meitner was nominated by the German Federation of University Women and Madame Ramart-Lucas by the French Federation.

THE Italian correspondent of the *Journal* of the American Medical Association writes that special honors were conferred on Professor Benedetto Morpurgo, the incumbent of the chair of general pathology at the University of Turin, on the occasion of his completing thirty-five years of instruction. Two volumes containing scientific articles by eminent Italian

and foreign scientific men were published to commemorate the event.

SIR ARTHUR NEWSHOLME, fellow of the Royal College of Surgeons and formerly principal medical officer of England and Wales, who is visiting public-health institutions in this country, was the guest of honor at a dinner on May 10 given at the Hotel Roosevelt, New York.

THE four hundredth meeting of the Washington Chemical Society took the form of a dinner in honor of Dr. F. W. Clarke, Dr. Harvey W. Wiley and Professor Charles E. Munroe, all of whom were early members of the Chemical Society of Washington, which later became the Washington section of the American Chemical Society. About one hundred and sixty members and guests were present.

AT the annual meeting of the American Association of Anatomists, Dr. Charles R. Stockard, professor of anatomy in the Cornell University Medical College, New York, was elected president and Dr. Lewis H. Weed, the Johns Hopkins University School of Medicine, Baltimore, reelected secretary.

PAUL J. KRUESI, of the Southern Ferro Alloys Company, Tennessee, has been elected president of the American Electrochemical Society, to succeed Professor S. C. Lind, of the University of Minnesota.

AT the meeting of the American Laryngological Association, which met in Washington, D. C., from May 1 to 3, Dr. Charles W. Richardson, of Washington, D. C., was elected president.

ON the occasion of the Linguistic Congress at the Hague in April an International Society of Experimental Phonetics was founded. The following elections took place: *President,* Professor E. W. Scripture, of Vienna; *vice-president,* Dr. E. A. Meyer, of Stockholm; *honorary members,* Professor A. Meillet, of Paris, and Professor L. Zwaardemaker, of Utrecht. The object of the society is the promotion of scientific research in experimental phonetics.

AT the annual business meeting of the Central Ohio Physics Club held at the Ohio State University on May 5, the following officers were elected for the coming year: *President,* Professor E. H. Johnson, of Kenyon College, Gambier; *vice-president,* Professor C. W. Jarvis, of Ohio Wesleyan University, Delaware; *secretary-treasurer,* Professor J. H. McCloy, Otterbein College, Westerville.

PROFESSOR THOMAS E. MCKINNEY, of the department of mathematics and astronomy of the University of South Dakota, will retire from service at the end of the present academic year on account of blindness.

G. H. COLLINGWOOD, head of the office of cooperative forestry extension of the United States Department of Agriculture, has been named forester for the American Forestry Association, to succeed Shirley W. Allen, who recently resigned to join the staff in the forest school of the University of Michigan.

DR. BLYTHE EAGLES, holder of a Sterling research fellowship in Yale University, who has been working with Professor T. B. Johnson on the chemistry of sulphur in blood, has accepted a research fellowship given under the auspices of the British Medical Research Council and will begin his work in England in October.

DR. J. J. NASSAU, professor of astronomy and director of the Warner Swasey Observatory of the Case School of Applied Science, who is spending the present academic year at the University of Cambridge in the laboratory of Professor Eddington, recently read a paper before the Royal Astronomical Society. Dr. Nassau will return to Cleveland in September.

DR. CHARLES F. MARVIN, chief of the United States Weather Bureau, is on his way to Europe for conference with the directors of meteorological services. One of the subjects to be discussed is the collection and interchange of ship reports.

DR. ERNEST L. WALKER, professor of tropical medicine, University of California Medical School, has returned from a fourteen months' stay in Honolulu, where he carried on investigations as to the cause of leprosy, at the invitation of the U. S. Public Health Service.

AT the annual meeting of the division of chemistry and chemical technology of the National Research Council, the following chemists were appointed as members of the official American delegation to the meeting of the International Union of Pure and Applied Chemistry, which is to be held at The Hague on July 18 to 24: Ross A. Baker, Syracuse University; Wilder D. Bancroft, Cornell University; Edward Bartow, University of Iowa; John B. Ekeley, University of Colorado; W. H. Gesell, Lehn and Fink; F. G. Keyes, Massachusetts Institute of Technology; W. Lee Lewis, Institute of American Meat Packers; R. B. Moore, Purdue University; A. M. Patterson, Antioch College; C. L. Reese, E. I. du Pont de Nemours and Company; L. H. Ryerson, University of Minnesota; Atherton Seidell, U. S. Public Health Service; W. T. Taggart, University of Pennsylvania; C. P. Smyth, Princeton University, and R. E. Swain, Stanford University.

DR. FRIDTJOF NANSEN, professor of oceanography at the University of Oslo, gave a lecture before the

Washington Academy of Sciences on May 16 on "The Problems of Arctic Exploration."

DR. S. A. KINNIER WILSON, lecturer on diseases of the nervous system at King's College, London, lectured on May 11 on "The Nature of the Epilepsies" at Cornell University Medical College.

DR. RICHARD P. STRONG, professor of tropical medicine at the Harvard Medical School, lectured at the Johns Hopkins University School of Hygiene and Public Health, Baltimore, April 17, on "The Harvard-African Expedition of 1926–1927."

THE thirteenth Mellon lecture of the Society for Biological Research of the University of Pittsburgh School of Medicine was delivered on May 10 by Dr. Hans Zinsser, professor of bacteriology and immunology at the Harvard Medical School, on "The Present State of our Knowledge regarding Epidemic Encephalitis."

DR. T. WINGATE TODD, Hamann professor of anatomy of the Western Reserve University, delivered the annual public address of the James A. Gibson Anatomical Society of the University of Buffalo on May 8 on "The Anatomy of Digestion."

ON the evening of April 20 Dr. Barnum Brown, of the American Museum of Natural History, gave the annual public lecture before the Syracuse chapter of the Society of Sigma Xi at Syracuse University on "Prehistoric Man in America."

IN the presence of more than 10,000 employees, the board of directors and a few invited guests, a bronze tablet honoring the memory of Charles A. Coffin, founder of the General Electric Company, was unveiled on May 8 at the Schenectady plant of that company. Ceremonies included an address by E. W. Rice, Jr., honorary chairman of the General Electric board. The fund which made the tablet possible was established twenty-five years ago by General Electric employees.

SUBSCRIPTIONS to the Bayliss and Starling memorial fund (see SCIENCE, April 20, page 414) have, within three and a half weeks of being opened, attained the sum of £1,400.

THE Commitee on Foreign Relations of the U. S. Senate has ordered a favorable report on the bill authorizing an annual appropriation of $50,000 to be paid to the Gorgas Memorial Institute of Tropical and Preventive Medicine in Panama. The gift would be dependent upon the completion of the institute within five years.

THE three hundredth anniversary of the birth of Marcello Malpighi, the founder of histology, was celebrated at Bologna on March 10.

DR. JOSEPH NELSON ROSE, associate curator of botany in the U. S. National Museum, died on May 4, aged sixty-six years.

DR. BIRD T. BALDWIN, head of the Iowa Child Welfare Research Station at the University of Iowa, died on May 12, aged fifty-three years.

PROFESSOR V. L. OMELIANSKI, the Russian bacteriologist, member of the Russian Academy of Science, died on April 21. Professor Omelianski was one of the corresponding members of the Society of American Bacteriologists.

PROFESSOR S. NAZAWA, of the University of Hokkaido, at Sapporo, died on March 23, after a winter trip to Otaru. Dr. Nazawa was a well-known ichthyologist of northern Japan. He devoted himself largely to the development of the fishing industry.

THE bacteriologist who died on February 14 from Rocky Mountain spotted fever was A. LeRoy Kerlee, not A. LeRoy Keyes as incorrectly reported in SCIENCE and in publications from which the information was obtained.

THE twenty-seventh annual session of the North Carolina Academy of Science recently took place at the University of North Carolina, under the presidency of Dr. J. M. Bell, professor of chemistry in the university. The following new officers were elected: *President,* J. S. Holmes, of the state forestry commission; *vice-president,* Mary Petty, of the North Carolina College for Women; *secretary-treasurer,* H. R. Totten (reelected), of the University of North Carolina; new member to the *executive committee,* F. A. Wolfe.

THE Sigma Xi chapters of Union College and Rensselaer Polytechnic Institute held a joint annual dinner at the Rensselaer Polytechnic Institute on May 4. This is the second of such joint annual dinners held by the chapters of these two institutions. Dr. W. D. Coolidge, of the research laboratory of the General Electric Company, was initiated to membership in the Union chapter. The chemistry and the physics departments of Union College took this occasion to present Sigma Xi keys to Dr. W. R. Whitney, Dr. Irving Langmuir and Dr. W. D. Coolidge, for valuable assistance given to these departments during the past years. The Rensselaer chapter presented a Sigma Xi key to Mr. John Knickerbacker, of Troy, who was one of the founders of Sigma Xi when it was organized at Cornell University in 1886. The main speaker of the evening was Dr. W. F. Durand, of Stanford University, who gave an address on the Colorado River problem, devoting himself to the economic and physical aspects, rather than the political.

THE Pasteur Society of Central California, recently organized under the tentative name of "Society of Bacteriologists," as recorded in SCIENCE (April 13), met in San Francisco on May 9. The new title was definitely voted upon as best representing the aims and ideals of the organization. The membership now numbers 125. Dr. J. C. Geiger, senior surgeon of the U. S. Public Health Service and associate professor of epidemiology of the University of California, addressed the meeting on "Scientific Aspects of Modern Health Department Organization," presenting the development of the Chicago department of health and its problems. The discussion was led by Dr. Charles F. Bacon, of Chicago.

THE annual spring field meeting of the Oklahoma Academy of Science was held at Prices Falls, Arbuckle Mountains, on April 20 and 21. The attendance was about 140, representing faculty members and students from fifteen institutions in Oklahoma and neighboring states. The subject of geology was stressed, and geological excursions were conducted each day. Bird walks were held each day, also tree walks and flower walks. Lectures were delivered at night as follows: "Stratigraphy of the Arbuckle Mountains," O. F. Evans, University of Oklahoma; "Flowers," Paul B. Sears, University of Oklahoma; "Hawks," R. O. Whitenton, A. and M. College; "Oklahoma Forest Trees," George R. Phillips, state forester; "Structure of the Arbuckle Mountains," V. E. Monnett, University of Oklahoma; "Science and History," Jas. S. Buchanan, vice-president of the University of Oklahoma; "The Oklahoma Academy of Science," O. M. Smith, president of the academy, Oklahoma A. and M. College. Chas. N. Gould, director of the Oklahoma Geological Survey, was general chairman in charge of the meeting.

ANNOUNCEMENT has been made of a gift of $750,000 for the development of the department of surgery of the Washington University in the Barnes Hospital. This sum will be expended for the construction of three additional floors on the surgical pavilion of the Barnes Hospital and for the surgical work in the hospital. Of the $750,000, $450,000 was contributed by the General Education Board and $150,000 each by Frank C. Rand, chairman of the board of trustees of Barnes Hospital and Jackson Johnson, a trustee of the Washington University. Construction of the new hospital wards will begin immediately.

THE biological stations of the United States Bureau of Fisheries at Woods Hole, Mass., Beaufort, N. C., and Fairport, Iowa, will open for the summer's activities on June 20. Facilities for research work will be afforded at the various stations to independent investigators and dormitory facilities will be provided as far as possible. Applications for space may be made direct to the Commissioner of Fisheries, Washington, D. C. There will be accommodations for the usual number of workers at Woods Hole, but more space will be available at the other two stations, and workers who can not be accommodated at Woods Hole will be offered equally good laboratory facilities at either of the other stations.

Comparative Psychology Monographs have been taken over by the Johns Hopkins Press, and will be issued hereafter under the managing editorship of Knight Dunlap. The board of editors consists of J. E. Anderson, for child psychology; H. A. Carr, for the lower vertebrates; W. S. Hunter, for general human problems; A. V. Kidder, for racial studies; S. O. Mast, for invertebrates, and R. M. Yerkes, for the primates. Manuscripts offered will be referred to the appropriate editor immediately, and will be considered for publication only after being approved by him.

UNIVERSITY AND EDUCATIONAL NOTES

THE reversionary bequest by Mr. E. J. Bles to the University of Cambridge of the residue of his estate (about £30,000) has been accepted and is to be used for founding a professorship of animal embryology or of biophysics in honor of Charles Darwin.

DR. FRANCIS ARTHUR THOMSON, dean of the school of mines at the University of Idaho since 1917, has been called to the presidency of the Montana State School of Mines at Butte.

DR. HERBERT C. SADLER, head of the department of naval architecture and marine engineering, has been appointed dean of the colleges of engineering and architecture at the University of Michigan.

DR. GEORGE R. ALBERTSON, acting dean of the school of medicine of the University of South Dakota, has been appointed dean to succeed the late C. P. Lommen. Dr. Albertson was appointed to the chair of anatomy at the university in 1912.

DR. ALFRED C. REED, a former member of the faculty of Stanford University School of Medicine, has been appointed professor of tropical medicine in the University of California Hooper Foundation for Medical Research and will take up his work in February, 1929. Dr. Reed is now studying at the London School of Tropical Medicine.

HOWARD F. JANDA, head of the civil engineering department of the University of North Carolina, has been appointed professor of highway engineering and city planning at the University of Wisconsin.

DR. G. E. HILBERT has been appointed as research assistant to Professor Treat B. Johnson, Sterling professor of chemistry at Yale University for the academic year 1928–29.

ASSOCIATE PROFESSOR A. ELIZABETH ADAMS has been promoted to a professorship of zoology at Mount Holyoke College.

HARRY N. EATON has resigned the associate professorship of geology at Syracuse University.

DR. W. B. CROW, lecturer in botany at the University College, Cardiff, has been appointed head of the department of biology at the Technical College, Huddersfield, in succession to Dr. T. W. Woodhead, who will soon retire.

DR. ADOLF FRAENKEL, professor of mathematics at the University of Marburg, has been called to the University of Kiel.

DISCUSSION AND CORRESPONDENCE

THE REAPPORTIONMENT BILL IN CONGRESS

HOUSE RESOLUTION 11725, reported favorably by the House Committee on the Census on April 4, 1928, presents an interesting scientific situation.

This bill, which provides for an automatic apportionment of 435 representatives after each decennial census (unless Congress takes other action), specifies the method of major fractions as the method to be followed in the computation; and the report of the Committee (no. 1137) describes this method of major fractions as a "specific, concrete and exact scientific method." As a matter of fact, this method is an obsolete method which has failed to secure the approval of any scientific body.

The problem of selecting the best method of apportionment is a mathematical problem of quite unexpected complexity, on account of the necessity of obtaining a solution in whole numbers. The problem has been the occasion of bitter debates in Congress for over a hundred years. Several different methods have been used and later discarded. On one occasion, after a long speech by Daniel Webster, the Senate reversed the action of the House on purely mathematical grounds. Not until 1921 did a satisfactory solution of the problem become available. In that year, at the request of Senator Sutherland, the Joint Advisory Committee to the Director of the Census held extensive hearings on the subject and published a unanimous report in favor of a method, then new, known as the method of equal proportions—a method which in point of simplicity, directness and intelligibility leaves nothing to be desired. This method has since been endorsed by a general consensus of scientific opinion. It was adopted in the only bill which came up in the House in 1927, and at that time, according to Hasbrouck's "Party Government in the House of Representatives" (p. 126), the "method of equal proportions was pretty generally favored over the method of major fractions which had been the basis of the 1911 apportionment." All the bills introduced in the House in the early part of this winter, which specified any definite method, specified, as a matter of course, the method of equal proportions. Moreover, the question of the choice of method is vitally important at the present time, since, if the proposed legislation is carried, there are conceivable distributions of population for which the choice of a wrong method might affect the number of representatives in every state in the Union.

In spite of these facts, the present report from the House Committee on the Census makes no mention whatever of the method of equal proportions and totally ignores the scientific report of the Advisory Committee. Why this sudden change?

The change is attributable entirely to the efforts of one man, Professor W. F. Willcox, of Cornell, whose testimony before the House Committee, as printed in the hearings for February 21, contains an entirely false description of the method of equal proportions, by which, supported as it was by impressive charts and diagrams, the committee was completely misled.

In a carefully worded paragraph on page 61, repeated with emphasis on page 62, instead of presenting the simple definition of the method of equal proportions which is well known in the literature of the subject, he substitutes therefor a complicated definition which bears no resemblance to the standard method and leads to strikingly different results. For example, suppose 100 representatives are to be apportioned among the five states A, B, C, D, E, in the following table, according to the method of equal proportions. Column I shows the result under the true method of equal proportions; column II shows the result under Professor Willcox's erroneous idea of that method. The results are different for four of the five states.

State	Population	I	II
A	12,972,500	52	51
B	11,000,000	45	44
C	345,000	1	2
D	342,500	1	2
E	340,000	1	1
	25,000,000	100	100

Other parts of his testimony are equally erroneous and misleading, but no opportunity was afforded for rebuttal, and the committee had no reason to question the accuracy of the information offered it. Moreover, after a number of these errors were called to Professor Willcox's attention, he declined to take steps to correct them.

From the scientific point of view there is another feature of the situation which is even more unfortunate. After admitting (p. 88) that "a large majority of mathematicians and statisticians are on record in favor of the method of equal proportions," Professor Willcox secured and read into the hearings about a dozen statements from constitutional lawyers and professors of political economy in favor of his method of major fractions and thus persuaded the committee that there is a conflict of opinion among scholars on this subject. Inasmuch as these scattered statements were secured by means of the same unsuspected misinformation that had misled the committee, they can not be regarded as concerted or final judgments.

There is of course no conceivable conflict of interest between the mathematicians on the one hand and the political scientists on the other hand. On the mathematical side the problem is a highly technical one, requiring investigation of scores of different methods; the results of the mathematical analysis are indispensable to the statesmen who must make the final choice between the small number of methods that are found to be logically possible and workable. Among the logically possible methods, the method of equal proportions is the only method which has the approval of any organized body of scholars. If Professor Willcox has any serious objections to offer against this method, he owes it to mathematicians and economists alike to publish his views in some regular journal, so that they may be accessible to the scrutiny of all groups of scholars.

This is not the place to go into any detailed discussion of the problem. Full references may be found in a recent paper in the Transactions of the American Mathematical Society for January, 1928. The important thing in relation to Congress is to have scientific opinion united on a scientific question.

Professor Willcox has himself suggested that the American Political Science Association might well appoint a committee to investigate and report on this subject. This is a suggestion which should be welcomed by all those interested in the constitutional aspects of the problem. If it is generally accepted, as seems now to be the case, that the provisions of the constitution are not intended to favor systematically either the smaller or the larger states in any apportionment of representatives, then the question becomes a purely mathematical one. The mathematical evidence, which was seriously misrepresented in the recent hearings, clearly indicates that the method of equal proportions is the one method which has no bias in favor of either the smaller or the larger states. It would be most unfortunate to have any other method incorporated in permanent legislation.

EDWARD V. HUNTINGTON
HARVARD UNIVERSITY

A POSSIBLE CORRELATION OF EYE SORENESS WITH VITAMIN A DEFICIENCY AMONG THE NEZ PERCÉS INDIANS

THE relation of vitamin A deficiency to a characteristic eye disease, known as xerophthalmia, keratomalacia, etc., was discovered by Osborne and Mendel in 1913 in their feeding experiments upon rats. Since the publication of their work various authorities have endeavored to determine whether a deficiency of vitamin A in the diet might not also be responsible for cases of eye trouble in man. The existing evidence upon this point by McCollum, Mori, Bloch and other observers has been summarized on pages 192 and 193 of Sherman and Smith's work upon "The Vitamins" of the American Chemical Society Monograph Series.

In the present note the writer wishes to call attention to what appears to be a much earlier recorded instance of eye soreness in man as a result of vitamin A deficiency. The references are contained in the journal of the expedition conducted by Lewis and Clarke to the northwestern territory of the United States in the years 1804–5–6, under the dates of May 10–12, 1806. The following extracts relate to observations made by the expedition during its stay with the Chopunnish or Nez Percés Indians within the present borders of Idaho. The page references are to Volume III of the "History of the Expedition under the Command of Captains Lewis and Clarke," published by the Allerton Book Co., New York, 1922.

> The chief spoke to the people, who immediately brought about two bushels of dried quamash roots, some cakes of the roots of cows (kouse), and a dried salmon trout: we thanked them for this supply, but observed that, not being accustomed to live on roots alone, we feared that such diet might make our men sick. (Page 102).
>
> Their chief subsistence is roots, and the noise made by the women in pounding them gives the hearer the idea of a nail factory. (Page 104.)
>
> We now resumed our medical labours, and had a number of patients afflicted with scrofula, rheumatism and sore eyes, to all which we administered very cheerfully as far as our skill and supplies of medicine would permit. We also visited a chief who has for three years past so completely lost the use of his limbs, that he lies like a perfect corpse in whatever position he is placed,

yet he eats heartily, digests his food very well, has a regular pulse, and retains his flesh; in short, were he not somewhat pale from lying so long out of the sun, he might be mistaken for a man in perfect health. This disease does not seem to be common; indeed, we have seen only three cases of it among the Chopunnish, who alone are afflicted with it. The scrofulous disorders we may readily conjecture to originate in the long confinement to vegetable diet; which may perhaps also increase the soreness of the eyes; but this strange disorder baffles at once our curiosity and our skill. Our assistance was again demanded early the next morning, Monday 12, by a crowd of Indians, to whom we gave eye-water. (Page 106.)

They then invited us into the tent, and told us that they now wished to answer what we had told them yesterday; but that many of their people were at that moment waiting in great pain for our medical assistance. It was therefore agreed that Captain Clarke, who is the favourite physician, should visit the sick, while Captain Lewis would hold the council. (Page 107.)[1]

Roots are all characterized by a very low vitamin A content and the absence of this important nutritional factor in the almost exclusively root diet of the Chopunnish Indians might very well give rise to eye soreness, a supposition which is hinted at with almost remarkable prescience in the report of the expedition. The cases of paralysis observed among the Chopunnish may also possibly have resulted from the lack of some necessary ingredient in the diet.

The observations of the Lewis and Clarke expedition upon the food and diseases of the various tribes of Indians which were visited are very complete but in no other case, besides the incident just cited, is the evidence so clearly marked of specific dietary deficiency on the one hand and of definite physical ailments on the other. With other tribes the use of roots was supplemented by the addition of cereals, vegetables, berries, nuts, fish and game. The general practice of the aboriginal Indians in eating the whole grain and in consuming all the organs of fish and game protected them no doubt from certain diseases which might have been incurred with the more civilized methods of preparing food.

C. A. BROWNE

BUREAU OF CHEMISTRY AND SOILS

THE LITER AND THE CUBIC DECIMETER

IN the original conception of the metric system of weights and measures all units of length, area, volume and mass were intended to be derived from the single basic unit of length, the meter, which was by definition equal to one ten millionth of the earth's quadrant from pole to equator. A cube having its edge equal to one tenth of the meter was provisionally adopted as the unit of volume, and was designated the cubic decimeter or the liter. The mass of this volume of water when at the temperature of its maximum density was provisionally adopted as the unit of mass, and was designated the kilogram.

It was found, however, that there were certain difficulties in the way of the practical realization of the original plan. For example, it was impracticable to determine accurately the length of the earth's quadrant and thus to fix the length of the meter on that basis. That difficulty was avoided by forsaking the original plan of deriving the meter from the figure of the earth and by defining the meter arbitrarily in terms of a specific material standard of length.

In attempting to establish the standard of mass in terms of the standard of length it was found that masses could be directly compared more accurately than they could be established through measurements of volume. It was, therefore, found advisable to depart again from the original plan and to define the kilogram arbitrarily in terms of a specific standard of mass without reference to the meter. Two arbitrary and independent standards were in that way established; the meter as the standard of length and the kilogram as the standard of mass.

As a result of the establishment of the kilogram independent of the meter there arose a need for a unit of volume which would also be independent of the meter. Such a unit was defined as the volume of a kilogram of water at the temperature of its maximum density. This new, or redefined, unit of volume was given the same name as that originally applied to the cube of one tenth of the meter; that is, it was still called the liter, although by the new definition it bears no direct relation to the cubic decimeter or to the meter. It is used in determinations of density and volume based on mass. That is, it is directly related to the kilogram.

We, therefore, now have two distinct units of volume in the metric system, the cubic decimeter derived from the unit of length and the liter derived from the unit of mass. These two units differ in volume by about twenty-seven parts in a million, the liter being the larger. The one thousandth part of the cubic decimeter is the cubic centimeter, and the one thousandth part of the liter is the milliliter. These units, of course, bear to each other the same relation as do the cubic decimeter and the liter, the

[1] The above references will also be found on pages 1002 to 1006 of Vol. III of the better known edition of the Lewis and Clarke expedition published by Elliott Coues in 1893.

milliliter being larger than the cubic centimeter by twenty-seven parts in a million.

It is a peculiar fact that although the one-thousandth part of the liter is the unit that is almost universally employed in measurements of volume and density of liquids, it is most often designated as the "cubic centimeter" or "cc" instead of by its correct designation "milliliter" or "ml." While the two units are so nearly equal as to be interchangeable for many purposes, yet the difference between them is sufficient to be very troublesome at times.

The only safe procedure is always to make sure which unit is being employed and then to designate it correctly. The preferable designation is "cm^3" for the cubic centimeter and "ml" (not "cc") for the milliliter.

It is unfortunate that the kilogram should not have been made a little lighter or the meter a little longer in order that the cubic decimeter and liter might have been equal and the original plan of interrelation of the units carried into effect.

H. W. BEARCE

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THE PASSING OF THE CIRCUIT SYSTEM OF COLLECTING WEATHER REPORTS

ON April 1, 1928, the Western Union Telegraph Company abandoned the circuit system, inaugurated in 1871 and used continuously since in collecting the twice-daily weather-reports from points in the United States and Canada.

A new and more flexible system was installed which obviated the necessity of withdrawing twice daily about 15,000 miles of wire from the usual commercial channels, for the exclusive use of the weather bureau. Two centers of collection and distribution, *viz.*, Chicago and New York, are a part of the new system. The largest factor in making the change was the very general use of automatic sending- and receiving-apparatus by the telegraph company in recent years whereby several channels of communication both ways are possible on a single wire.

The old system required hand operation, and traffic could flow but one way at a time.

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THE ABNORMAL SPECIFIC HEAT OF A RAREFIED GAS AT A LOW TEMPERATURE, AND THE COSMIC RADIATION

IN a paper that will appear in the May number of the *Journal of the Franklin Institute* it is shown thermodynamically that a gas at a very small molecular concentration, at which it is largely or altogether in the atomic state, near the absolute zero of temperature, has an abnormally large specific heat which may amount to thousands of calories per gram. This is due to three separate effects, each of which need not always occur. One of them is intimately connected with the remarkable result also obtained thermodynamically that the internal heat of evaporation of all substances is zero at the absolute zero of temperature. This result was obtained by means of the result deduced previously by the writer[1] that the adiabatic of zero entropy corresponds to zero absolute temperature. It was also obtained independently of considerations of the zero of entropy, thus incidentally furnishing welcome evidence from another direction of the truth of the foregoing result.

These abnormally large specific heats—they are likely to be specially large in the case of gaseous C, H_2, O_2 and N_2—are bound to be attended by great changes in the electronic configuration of the atoms with decrease of temperature, during which some of the electrons are likely to fall through very high potentials. This would give rise to an electro-magnetic radiation some of which might conceivably be of greater penetrating power than the γ radiation of radium. The cosmic radiation which appears to come from interstellar space might well be caused in this way. For no doubt this space contains various gases, especially the above, at an extremely low molecular concentration, whose temperature is near the absolute zero and still decreasing.

Since the air in the upper region of the atmosphere is at a low concentration and temperature, it is not improbable that a large part of the cosmic radiation proceeds from this region. If that is so the radiation arriving in a horizontal direction would be larger for a given solid angle than that in a vertical direction, a deduction which could be tested experimentally.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

MACROSCOPICAL DETECTION OF THE MEDULLATED WOOL FIBER

The medullated wool fiber is considered a serious defect in the fleece. In the United States little if any attention has been given the problem of its elimination, possibly because most of the woven fabrics manufactured for clothing purposes in this country

[1] *J. Phys. Chem.*, 31, 940, 1927.

are made from the finer grades of wool, among which the medullated fiber does not so frequently occur. Among British wool manufacturers, however, the medullated fiber is looked upon as a menace to the prestige of British woven fabrics. It is thought to be responsible for harsh, wiry fleeces which do not work up well in the manufacturing processes. The medullated fiber is also criticised for lack of tensile strength and elasticity, and by some is accused of being responsible for uneven dyeing of certain goods.

Medullated fibers may be found among most of the improved breeds of sheep, including the Merino, but it is found in greatest quantity among the long-wool breeds, such as the Lincoln, Leicester, Cotswold and Romney. Sharp criticism of some New Zealand crossbred wools has recently been made by certain leading figures in the British textile trade, who point to the very great desirability of eliminating those "strong" or "hairy" fibers from the fleece. Obviously such elimination must be made by the breeder, if it is to be accomplished at all.

The presence of the medullated fiber can not be accurately detected by simple optical examination of the fleece, although the medulla is easily seen under the low power of the microscope when the fiber is prepared in a balsam mount. The literature on the subject contains no references to macroscopic detection.

A problem recently undertaken by the writer, involving the isolation of several thousand medullated fibers, led to the discovery of a method of detecting medullated wool fibers without the aid of a microscope. The method is simple and its use by breeders as well as by investigators seems warranted.

A rectangular piece of glass, of a size somewhat shorter in one dimension than the length of the fibers to be tested, is placed horizontally over a dull black or dark blue background. A small quantity of glycerin is then poured on the glass. The glycerin will have a tendency to spread over the glass and thus gradually become too shallow in depth to permit proper immersion of the fiber. This difficulty may be overcome by making on the glass a wall of paraffin in the shape of a parenthesis almost joined at the top and bottom. The fibers are cleaned in benzene to remove the excess of natural oil and dirt, and then are immersed one at a time in the shallow lake of glycerin. The ends of the fiber are held in the fingers and the two openings in the wall of paraffin permit the fiber to be held completely submerged and almost in contact with the glass.

The operation is carried on in natural light subdued to a point where reading would be difficult. The writer has found it convenient to work close to a window and to regulate the light by manipulation of a piece of very thick felt used in place of the ordinary window blind.

If the light has been properly regulated, a medullated fiber subjected to the treatment described can be seen as a faint white line across the glass, while non-medullated fibers can not be seen at all.

Tests of the efficacy of the method were carried out by examining under the microscope many fibers, both medullated and non-medullated, separated by use of the glycerin. These tests showed no errors in isolating medullated fibers, although a few which contained only traces of medullae were classed as non-medullated. The method is applicable to the examination of wool from any of the long-wool breeds, and with practice might be applied to finer fibers.

Tests with liquids other than glycerin, having a high refractive index, suggest that the index of refraction may be responsible for the phenomenon. Cottonseed oil, aniline, balsam, and other substances give fairly satisfactory results, while with water the detection is impossible.

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A PERFUSION FLUID FOR ELASMOBRANCHS

THE use of diluted sea-water as a perfusion fluid for vertebrate tissues has been attended in the past with only partial success. Failure in the case of elasmobranch hearts, at least, was considered by Mines[1] to be due to the excessive magnesium content. The ratio of Mg to the other metals is about five times as great in sea-water as in elasmobranch serum, and about fifteen times as great as in the sera of land vertebrates.[2] Since the relative proportions of Na, K and Ca in sea-water are very similar to those found in vertebrate tissues generally, it seemed that the Mg might be the only disturbing factor.

It has been found possible to precipitate most of the Mg and relatively little of the Ca from sea-water by the addition of NaOH. To each liter of sea-water is added 12 cc of a 10 normal solution of NaOH, and the mixture is allowed to stand overnight in a stoppered flask. The flocculent precipitate settles in a compact mass at the bottom of the flask, and the supernatant liquid may be decanted easily through a filter. If the precipitate is not allowed to settle completely, filtration is unduly slow. The filtrate, after neutralization to pH 8 with a few drops of concen-

[1] Mines, G. R., "On the Relation to Electrolytes of the Hearts of Different Species of Animals," I—Elasmobranchs and Pecten, *Jour. Phys.*, 1912, 43, 467.

[2] Macallum, A. B., "The Paleochemistry of the Body Tissues and Fluids," *Phys. Rev.*, 1926, 6, 316.

trated HCl, may be used as the stock solution for a perfusion fluid which has proved highly satisfactory for dogfish and skate hearts. Preparatory to its actual use, this modified sea-water must be diluted as follows:

Modified sea-water	30 cc.
Urea, 20 per cent. sol.	10 cc.
Distilled water	60 cc.

The acidity will then need to be adjusted with dilute HCl to pH 7.4, to correspond with the pH of elasmobranch serum. The diluted mixture compares favorably in its physiological effects with Knowlton solution, the standard artificial salt-mixture for elasmobranch tissue; and it has the advantage of being much simpler and cheaper to make up.

Determinations of the Ca and Mg content of solutions prepared in this way yielded the following results. Unmodified sea-water similarly diluted and Knowlton solution are included in the table for comparison:

	Ca-Mols/liter	Mg-Mols/liter
Modified sea-water (a)	.0020	.0037
" " " (b)	.0019	.0046
" " " (c)	.0021	.0042
Plain sea-water	.0032	.0145
Knowlton solution	.0040	.0050

A detailed study of the precipitation of Ca and Mg from sea-water by NaOH[3] shows that the removal of more Mg entails the loss of so much Ca and the gain of so much Na that the physiological salt-balance is destroyed. It is therefore impossible to extend the foregoing technique to the preparation of a medium suitable for land-vertebrates.

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SPECIAL ARTICLES

THE SEXUAL STAGE OF FUNGI INDUCED BY ULTRA-VIOLET RAYS

ON January 29, 1928, while studying the effect of ultra-violet radiation of fungi in agar plate cultures radiated on January 25, it was noted that perithecia, the sexual stage of the fungus, had formed in great numbers on certain portions of the exposed plates.

The fungus under consideration was one, our laboratory number "G 10," of several strains of *Glomerella cingulata* that have been under close observation for some months. This culture was originally derived from apples affected with Bitter Rot and in October a single conidium was isolated in my laboratory. All cultures of "G 10" since that time have been from this monosporous strain. In no case were perithecia observed to develop on this monosporous strain.

This same essentially non-sexual strain in all agar cultures exposed to ultra-violet rays of certain intensity and for certain time develops perithecia literally by millions. Thus in the plate represented in the figure more than one hundred perithecia were visible in one focus of one low power field of the microscope or more than 1,500 on the exposed region of this small colony. It will be observed that no perithecia developed in the non-radiated part. Perhaps the most striking evidence that the radiation induces the perithecia was given by projecting the rays through a circular aperture of 0.5 mm. diameter upon a susceptible colony. The perithecia developed in great quantities in the small area radiated and only in that area. Their origins are visible two days after radiation as hyaline globose bodies and they can probably be traced to a much earlier time, since unusual branching is apparent within a few hours after radiation. In four days they appear as well-developed, spherical black bodies; asci and spores soon form. The perithecia differ from those naturally formed in that they are spherical and non-stromatic, but the asci and spores agree precisely with those found in nature.

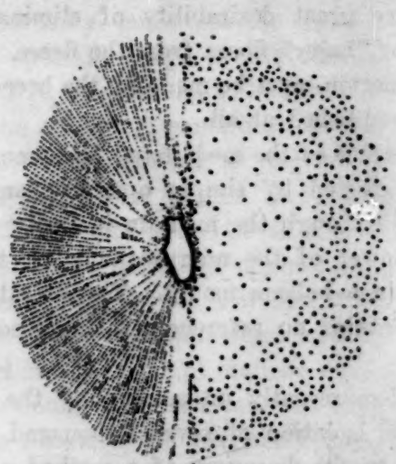

FIG. 1. Portion at right directly radiated; at left not so. Dotted region is perithecial; these on the right induced by direct radiation, the few at the left by indirect radiation.

All other strains of Glomerella that have been tested have given responses like those of "G 10." It appears certain that these ultra-violet rays or others near them have also a greatly accelerating effect on conidial production in this and other genera of fungi, for example, a Coniothyrium that normally produces pycnidia only at the end of several weeks and when the colony has completely occupied the petri dish, when radiated responds within a few days with numerous pycnidia.

[3] Kapp, E. M., Unpublished.

Exposure was to full radiation from a Cooper Hewitt quartz mercury arc, half of the colony shaded with cardboard to serve as a control. Two kinds of radiation resulted in perithecia: a, direct rays upon the exposed half of the colony, which resulted in perithecia deeply buried in the agar; b, indirect rays diffused to a few millimeters under the edge of the cardboard shield, which gave superficial perithecia.

The activating region of the spectrum has been determined by means of various screens as in the far ultra-violet, probably between the Ångstrom wave-lengths of 2760 and 3130.

That the effect is not the result of a chemical change produced in the medium by the radiation, but is a direct response by the mycelial cells to radiation, is rendered extremely probable by the results of several experiments directed to this special question.

Studies are now being made to determine the exact wave-lengths involved and the effect of these rays upon other species and genera of fungi both of the Ascomycetes and Fungi Imperfecti; the relation of the age of the mycelium to its susceptibility to stimulation; and the various steps in the development of the perithecium from the time of stimulation onward.

A presentation of this study was made at the meeting of the Illinois Academy of Science in April and a more complete account will be published soon in the *Botanical Gazette*.

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THE AMIDE NITROGEN OF BLOOD

WHEN it was established by Folin and Denis[1] that blood contains exceedingly small quantities of ammonia, it became necessary to consider whether or not such amounts were capable of furnishing the ammonia found in urine by simple excretion by the kidney.

Nash and Benedict[2] reasoned that the kidney must form the ammonia it excretes because they found no increases in blood ammonia with kidney ablation, and increases in urinary ammonia seemed to be unaccompanied by significant increases in the ammonia content of blood. Their belief in the special ammonia-forming function of the kidney was strengthened by their observation that the blood leaving the kidney is richer in ammonia than the blood that enters it.

The subsequent finding of Bliss[3] that other organs, notably the pancreas, show increases of ammonia in the blood leaving the organ suggested that ammonia formation, instead of being limited to the kidney, is a general tissue phenomenon.

He was not only able to demonstrate accumulations of ammonia in the blood of nephrectomized dogs, but found that such dogs only maintain low levels of blood ammonia concurrently with the elimination, by way of vomitus, of amounts of ammonia quantitatively comparable to their normal urinary excretion of ammonia.

While unsuccessful attempts have been made to demonstrate the existence of complex ammonia combinations in blood, this phase of the subject has now been studied with very favorable results. The demonstration of ammonia in a form not yielded by the ordinary methods, yet available within the body under the influence of enzyme action, would clear up a large body of facts already known about ammonia metabolism.

It seemed that the kidney might possess an enzyme that is capable of liberating ammonia from its combination in blood, and the search for such an enzyme revealed its presence.

The determination of ammonia that is obtained from blood by the use of this new kidney enzyme furnishes amounts of ammonia approximately a thousand times the old value—and for human blood the value is 115–125 mg instead of 0.05 to 0.10 mg nitrogen per 100 cc blood.

When purified casein was tried as a possible substrate for the enzyme, ammonia was liberated in appreciable amounts.

Using casein as a substrate, the new enzyme was compared with trypsin as to the rate of formation of amino-nitrogen and ammonia. Hunter and Smith[4] found that 37 per cent. of the casein nitrogen was in the form of amino-nitrogen after twenty-four hours' contact with trypsin, while the kidney enzyme liberated somewhat less than that amount in three days. A comparison of the formation of ammonia from casein by both enzymes shows that the kidney enzyme is much more specific for ammonia formation. Trypsin yielded 0.8 per cent. of the total casein nitrogen as ammonia in twenty-four hours, and 4.26 per cent. in eighty-eight days, while the kidney enzyme liberated more (5.1 per cent.) in four days than had trypsin in eighty-eight days (4.26 per cent.).

Hunter and Smith say:

> The absence of relation, in our experiments, between peptolysis and amidolysis is so conspicuous that these processes would really seem to have been catalyzed by two separate enzymes. We venture accordingly to suggest, as a working hypothesis, that the liberation of the

[1] Folin, O., and Denis, W., *J. Biol. Chem.*, xi, 161 (1912).

[2] Nash, T. P., Jr., and Benedict, S. R., *J. Biol. Chem.*, 1921, xlviii, 463.

[3] Bliss, Sidney, *J. Biol. Chem.*, 1926, lxvii, 109.

[4] Hunter, Andrew, and Smith, Ralph G., *J. Biol. Chem.*, 1924, lxii, 649.

amide-nitrogen of proteins is not, strictly understood, a function of trypsin at all, but is to be attributed to the action of a specific enzyme, possibly of tissue origin, by which trypsin as usually prepared is liable to be accompanied.

The discovery of the enzyme in kidney seems to justify the opinion quoted from Hunter and Smith—and this enzyme has been shown to be directly concerned with ammonia metabolism.

The action of the kidney enzyme suggested so strongly that it was amide-nitrogen that was being attacked that the more simple, direct and accurate method of acid hydrolysis was tried. This was particularly indicated by the fact that no ammonia was ever liberated by the new enzyme from the protein-free fraction of blood, so that it was possible to use the blood proteins only for the ammonia determination.

Acid hydrolysis was found to give results of the same magnitude as those obtained by the use of the new enzyme. The method that was developed is now in the course of publication elsewhere.

The amide-nitrogen of blood is to be carefully distinguished from the conception of an ammonia-precursor or ammonia "mother-substance." From the metabolic standpoint it has been shown by studying the changes in amide-nitrogen during changing conditions of acid-base balance in the body that the amide-nitrogen of blood comes from ammonia formed in the tissues.

Parnas[5] has measured the ammonia that develops when blood is allowed to stand, and his values, which are only 2 to 4 per cent. of the values hereby established, he has designated as representing an ammonia-precursor or "ammonia mother-substance." The work of Parnas has, therefore, no relation to the presence of amide-nitrogen. After considerable study by himself and collaborators, Parnas concludes that his "ammonia mother-substance" bears no relationship to the state of acid-base balance: "Es wird daraus geschlossen, dass die Ammoniakmuttersubstantz des Blutes eine andere physiologische Funktion hat als *Ammoniak* als solches zu bilden, und dass aus den abgespaltenen Aminogruppen in vivo andere Stickstoffverbindungen entstehen."

In the latest articles that have come to the attention of the writer, the "ammonia mother-substance" of Parnas has been abandoned and the attempt made to attach metabolic significance to the exceedingly low values for ammonia which must now be considered as accidental values developed during the course of the analysis.

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[5] Parnas, J. K., and Heller, J., *Biochem. Ztschr.*, 1924, clii, 1.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

THE SPRING MEETING OF THE EXECUTIVE COMMITTEE

THE regular spring meeting of the executive committee of the council of the American Association was held at the Cosmos Club, in Washington, on Sunday, April 22, with the following members present: Cattell, Curtiss, Humphreys, Johnston, Kellogg, Livingston, Wilson. The absent members were: Moulton, Osborn, Pupin, Ward. The chairman, Dr. J. McKeen Cattell, presided. The following is a summary of the business transacted.

1. The minutes of the last meeting were reported as having been approved by mail.

2. The permanent secretary reported that, since last September 30, there had been a net increase in membership of 1,453. The number of members in good standing on April 21st was 15,074, with 1,241 additional names on the roll, but in arrearage for dues for one or two years. The total number of names on the roll was therefore 16,315. The number of those in arrears was proportionately somewhat less than for the same date last year. About next October 1 there will be sent out between 75,000 and 80,000 invitations asking non-members to join the association. Members are asked to continue to send to the Washington office names of persons who might be interested to join.

3. A letter was read from William L. Corbin, librarian of the Smithsonian Institution, who said, in part: "I am writing to thank you and, through you, the American Association for the Advancement of Science, for the very generous gift of miscellaneous publications that the association made not long ago to the Library of the Smithsonian Institution. We are deeply appreciative of this gift and most grateful for it. Already, in checking up these publications, we have discovered hundreds of complete volumes and parts of volumes needed in our standard sets. Not a few of these we had found it impossible before to get from any source. Other volumes and parts of great value to us are coming to light every day as the work of sorting the contents of the boxes goes on."

4. It was voted that the regular fall meeting of the executive committee will be held at the Cosmos Club, in Washington, on Sunday, October 21, 1928, the morning session to open at 11 o'clock.

5. A committee of three was named, to cooperate with the section committee of Section K (Social and Economic Sciences), to elect a section secretary and to arrange for the section at the approaching New York meeting. This committee consists of J. McK. Cattell, B. E. Livingston and Edwin B. Wilson, the last mentioned being chairman.

6. Dr. Wesley C. Mitchell, director of research,

National Bureau of Economic Research, was elected a member of the section committee of Section K for the term of office ending at the close of the annual meeting of December, 1931.

7. A special committee on linguistic sciences in the association was named, as follows: George M. Bolling, B. E. Livingston and Edward Sapir, the latter being chairman. This committee was requested to consider further the problems of Section L (Historical and Philological Sciences) with special reference to the needs of those interested in the linguistic sciences. It was also asked to name a chairman and a secretary for the section from the field of linguistics, to name an eminent scientist in this field to represent it by an address at the approaching New York meeting, and to arrange for a suitable program in linguistics for that meeting.

8. A petition from the Linguistic Society of America, for a special section on linguistic sciences in the association, brought up the general problem of section classification and subdivision, and it was the consensus of opinion of the executive committee that it would be well to consider in the near future the suggestion that a new arrangement of association sections be adopted, with perhaps just three sections or divisions (exact, natural and humanistic sciences, for example) instead of the present larger number. If such a plan were adopted there might be several subsection organizations in any section and the affiliated societies would function, in Association organization, as subsections. There would then be only three association vice-presidents and only three retiring vice-presidential addresses at an annual meeting. This suggestion should receive further attention.

9. Dr. R. G. Hoskins, of the Harvard Medical School, Boston, Mass., was elected to the secretaryship of Section N for the current year, his term to expire at the close of the fifth New York meeting.

10. In view of the present vacancies, caused by death and resignation, in the committee of one hundred on research and in its subcommittees, which will need to be filled in the near future, it was voted that the term of office of members of the committee and of its subcommittees shall extend from the time of their election to the close of the next following annual meeting of the association. It was also voted that the present members of the committee and of its subcommittees shall hold office till the end of the fifth New York meeting.

11. The executive committee expressed its great regret at the resignation of Dr. Maynard M. Metcalf, secretary of the subcommittee on research in educational institutions and chairman of the joint committee on research in colleges, and its appreciation of the work accomplished under Dr. Metcalf's leadership.

12. Dr. C. E. Seashore, dean of the Graduate School, University of Iowa, was named secretary of the subcommittee on research in educational institutions and the executive committee expressed its hearty approval of a continuation of the joint committee on research in colleges, if that seems desirable to the other organizations that have taken part in the work of the joint committee. These are as follows: National Research Council, American Council on Education, American Association of University Professors, American Council of Learned Societies, Social Science Research Council.

13. It was voted that matters coming before the executive committee of the association from the committee of one hundred on research or from its subcommittees shall be considered first by the executive committee of the committee of one hundred, which shall transmit them, with recommendations, to the executive committee of the association.

14. A report on the work and prospects of the committee of one hundred on research was presented, from Dr. Rodney H. True, secretary of the committee of one hundred, which was accepted and referred to the executive committee of the committee of one hundred, with power to arrange for carrying on the work of the committee until the end of the fifth New York meeting, including the use of treasury funds in that period to amount to not more than one thousand dollars.

15. The executive committee of the committee of one hundred on scientific research was asked to present to the executive committee of the association, for consideration at its next regular fall meeting, a plan for the future organization and work of the committee of one hundred.

16. It was voted that, for the four-year period beginning at the end of the fifth New York meeting, any member of any affiliated organization may join the American Association without paying the entrance fee.

17. It was voted that the price of the next volume of Summarized Proceedings and Directory of Members (which is to be published in the fall of 1929) shall be $2.50 (or $3.50 bound) to members who remit for it in advance of publication; $3.00 (or $4.00 bound) to members who remit for it after publication, and $4.00 (or $5.00 bound) to non-members.

18. The question of the desirability of altering the rules by which the annual American Association prize of $1,000 is awarded was considered, having been taken up previously by the permanent secretary in correspondence with the members of the executive committee, and it was voted to make no changes at this time. The permanent secretary was asked to arrange a committee of five to decide on the New York award of the prize, vice-presidents and retiring vice-presidents being considered especially suitable for appointment to this award committee.

19. The following resolution was adopted, recommending to the Congress of the United States the establishment of a National Institute of Health:

Resolved: That the Executive Committee of the American Association for the Advancement of Science, approving the action taken by the medical section of the association at Nashville, and representing the 16,000 members of the association, urges Congress to give special consideration to the desirability of providing means of maintaining human health in some such manner as is outlined in the Ransdell bill, S. 5835.

20. The academy conference was requested to consider the problem of providing increased facilities for the encouragement of junior scientific effort (reference being made to the article of Thomas Large, SCIENCE for March 9, 1928, page 272) and the conference was asked to make suggestions and recommendations on this subject for consideration by the executive committee at its next regular fall meeting on October 21. It was also requested that this subject be made a special order of business at the New York conference of academy representatives.

21. The following resolution was adopted concerning the provision of courses in elementary German and French in high schools:

Resolved: That it is highly desirable that all who are to undertake work in science should be familiar with German and French, and that a knowledge of these two languages should be acquired by students before they enter college.

22. Michael I. Pupin and J. McKeen Cattell were named as official delegates to represent the American Association at the conferring of a gold medal on Thomas A. Edison by the Society of Arts and Sciences on May 24, at the Astor Hotel in New York City.

23. A committee of three was named, to cooperate with the American committee on preparations for the World Engineering Congress to occur at Tokio in 1929. This committee consists of: E. Lester Jones (chairman), Robert L. Sackett (vice-president for Section M) and N. H. Heck (secretary of section M).

24. An appropriation of $50 from the permanent secretary's funds was made to aid the educational work of the American Institute of Sacred Literature.

25. In response to a request for a final subscription to aid the work of the National Conference on Outdoor Recreation, an appropriation of $50 was made for that purpose, from the permanent secretary's funds.

26. An appropriation of $100 from the permanent secretary's funds was made to aid the American Library Association's committee on work with the blind, to secure the printing of scientific books in Braille.

27. The American Library Association was officially affiliated with the American Association for the Advancement of Science. It is to have one representative in the association council.

28. The executive committee invited the Archaeological Institute of America to become affiliated with the American Association.

29. The College Art Teachers were invited to take part in the fifth New York meeting and to arrange a scientific program.

30. The American Philological Association was invited to have its New York program included in the General Program of the fifth New York meeting and to be otherwise the guest of the American Association as far as that may seem desirable to the Philological Association.

31. Sixty-nine members were elected to fellowship, distributed among the sections as follows: Section A, 1; Section B, 37; Section C, 2; Section E, 1; Section M, 21; Section N, 4; Section O, 1; Section Q, 2.

32. The permanent secretary was instructed to send, with the statement cards to be mailed next October 1, requests to all members asking for nominations for president of the association, as was done October 1, 1927.

33. A nominating committee was named for the fifth New York meeting, to present to the council nominations for general secretary, permanent secretary, treasurer, two executive committee members (to succeed Vernon Kellogg and Edwin B. Wilson), two council members (to succeed L. O. Howard and D. T. MacDougal), two members of the committee on grants for research (to succeed Joseph Erlanger and Nevin M. Fenneman), a member of the finance committee, and a representative of the association on the board of Science Service. The members named for the nominating committee are: Edwin G. Conklin (chairman), L. E. Dickson, Edward L. Thorndike, David White and Charles E. Mendenhall.

34. The permanent secretary was instructed to secure several nominations for secretary of each section and to present them to the executive committee at its fall meeting on October 21, elections to be by the council at the fifth New York meeting.

35. The permanent secretary reported that plans and arrangements for the approaching New York meeting were well advanced, that President Henry Fairfield Osborn is arranging a number of attractive special features, and that the local executive committee has held a number of meetings and has the various details of the preparations well in hand.

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SCIENCE NEWS

Science Service, Washington, D. C.

RADIO MOVIES

RODS of quartz, through which light is transmitted like water through a hose, make possible the latest method of television—the radio movies demonstrated by C. Francis Jenkins, Washington inventor. As a result he is able to substitute a seven-inch drum for the two- or three-foot disc that previous methods of television have employed.

If light is allowed to shine into one end of a rod of fused quartz, it is reflected back and forth as it goes through it. Practically none is lost by leaking out the side, but all emerges through the end.

In the Jenkins home radio movie receiver, which may soon become a common attachment to radio sets, the current from the set, instead of operating the magnets of a loud speaker, causes a glow of a small metal plate sealed in a bulb containing the rare gas, neon. Such a neon lamp glows immediately, as soon as the current is turned on, and is extinguished as soon as the current is turned off. The ordinary filament of the incandescent lamp continues to glow for an instant after the current stops, and so can not respond to the rapid changes required by the television receiver.

In previous methods of seeing by radio, either of movies, or actual objects, the person viewing the received image gazed directly at the surface of a neon lamp. A revolving disc with a spiral row of holes obscured all but the proper spot of the neon glower. These spots of light, seen in rapid succession, were built up into the complete picture seen by the observer, just as the successive pictures of a movie film shown in a theater merge together into a continuous view on the screen.

Mr. Jenkins employs a cylindrical glass tube, in which there is a row of small neon glowers. This is at the center of a revolving drum, seven inches in diameter. Around the surface of the drum is a helical row of small holes. Extending from these holes, inside the drum, to an inner cylinder, almost in contact with the neon lamp, there are a number of the quartz rods, about two inches long, somewhat resembling the wire spokes of a bicycle wheel.

An ordinary electric motor, which is arranged to run in synchronism with the motor at the transmitter, spins the drum around at a speed of 3,600 revolutions a minute. A revolving contact, or commutator, attached to it serves to connect the separate glowers in the neon tube, and so enables the current from the radio receiver to light them at the proper time. The light from the glowing neon tube is carried by the quartz rods out to the round surface of the revolving drum, where the picture is actually seen. Thus a small neon lamp is made to serve the purpose of a much larger one, one as large as the drum itself. The drum turns on a horizontal axis, so a slant mirror and a large magnifying lens enable the persons viewing it to see the picture vertically, as on a movie screen.

In his demonstration Mr. Jenkins used a motion picture film as the original object, and this was reproduced both by wire, in another part of his laboratory, and by radio, in his home some miles distant. However, he claims, the apparatus is just as applicable to the broadcasting of views of actual persons or objects. The received picture is a silhouette, and does not show gradations of light and shade. This, he thinks, is not a serious objection, but it is one which he expects to overcome. "At present," he says, "the apparatus is in the 'crystal set stage.'" Future developments, he promises, will bring it to the perfection of present-day radio or movies.

A NEW METHOD OF TRANSPORTATION

A NEW method of transportation with the motive power furnished by spurts of expanding gases, like the trail of a Fourth-of-July rocket, is about to make a bid for practical success.

After secret experimental development, a rocket automobile has been given speed tests at the racing track of the Fritz Opel motor car factory at Russelsheim near Frankfort, where it was built. Speeds of slightly over 60 miles an hour were attained eight seconds after the start.

A demonstration before experts at the Avus racing track in Berlin is scheduled for the near future. As the speeds on this track are limited to a hundred miles an hour, plans are under way to utilize later a stretch of railroad track which has been offered for this purpose by the German States Railways.

The theoretical investigations which inspired this rocket-propelled automobile were begun by Professor R. H. Goddard, American scientist, who designed a rocket that would travel to the moon. Later mathematical studies were made on the same problem by Professor Max Vallier, of Munich, and Albert Mueller, whose results were available to the Opel Company's designing engineer, Sander.

Tests of the rocket automobile are believed to be merely preliminary to the construction and launching of a rocket airplane capable of arising to heights that ordinary propeller-driven airplanes can not possibly attain. Journeys to other planets across the great distances of airless space are theoretically possible through the use of the rocket exhaust kick as the motive power. For experiments show that the kick of the exploding rocket charge is just as effective in a vacuum where there is no air as it is under ordinary conditions where there is plenty of atmosphere. Propellers of ordinary airplanes need the air to work against. The rocket is effective in vacuum for the same reason that a rifle fired in an airless chamber would have the same sort of kick that it would in air.

The rocket airplane, once it reached the airless outer space or the upper rarefied portion of the atmosphere,

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LIVER DIET FOR ANEMIA

THE liver treatment for pernicious anemia recently developed in America has given great success in the hands of British physicians.

Drs. Stanley Davidson, J. G. McCrie and G. Lovell Gulland, of Edinburgh, have announced through *The Lancet* that in their experience the feeding of liver and liver extract has helped anemia patients more promptly and regularly than any former method.

"The most important point," they declare in their report, "is that recovery is more complete. Formerly one had too often to be content with a count of about 3,500,000 red blood corpuscles (per cubic millimeter); now an extra million or more may be confidently expected; the whole blood picture returns to normal with much greater frequency and certainty, and apparently remains so indefinitely, so long as the treatment is persevered with."

The benefits of a liver diet for pernicious anemia were put before the medical world about two years ago by Drs. G. R. Minot and W. P. Murphy, of Boston, Mass. The method has sprung into wide-spread use with the result that calves' liver now retails in the United States for ninety cents a pound.

Half a pound of liver daily, however, is for many patients a gustatory impossibility. Many acquire a distaste for it that can not be overcome even to recover from a hitherto incurable disease. To surmount this difficulty, Dr. E. J. Cohn and a group of collaborators at Harvard University have endeavored to isolate the active principle in liver in a liver extract. Five to fifteen grams of this concentrated form is equal to 200 grams, or approximately 6 ounces, of whole liver and produces corresponding effects. Liver extracts from the United States, Germany and Great Britain are now on the market and give about equally good results. Since the extracts are soluble in water a single dose, equivalent to nearly 30 ounces of whole liver, can be given to a patient too weak to take solid food.

SERUM FOR ALL TYPES OF PNEUMONIA

A NEW serum for treating pneumonia, developed by Dr. L. D. Felton, of Harvard University, has given very promising results in combatting this highly fatal disease. The serum marks an advance in that it can be used for all four of the recognized types of pneumonia, according to Dr. Russel L. Cecil, of the Bellevue Hospital, New York City, who has obtained very efficacious results from its use in the pneumonia clinic of that hospital. It works best with types one and two, the two groups that comprise the majority of pneumonia cases. The recoveries after its use with type one have been very encouraging, indeed, Dr. Cecil declared, though the deadly type three, which always has had a very high death rate, has proved the least amenable of any group.

Pneumonia serums used in the past have been specific for each type. Since certain laboratory procedures have to be followed out before the type from which the patient is suffering can be determined, precious time often has to be lost before the doctors know which serum to give. The Felton serum of mixed cultures can be administered on admission to the hospital and frequently a gain of many hours can be made in checking the course of the disease.

CATNIP OIL AS A BAIT

BOBCATS, mountain lions and lynxes, which assist in destroying from $20,000,000 to $30,000,000 worth of game and livestock each year, are being baited on a large scale with catnip oil, according to the United States Biological Survey.

Prior to the discovery that catnip makes an effective bait the taking of mountain lions particularly presented a serious problem to hunters and trappers. They frequent rough, inaccessible country and had to be trailed with dogs and shot after being driven into caves or up trees. Last year literally hundreds were lured to traps and poisoned bait with catnip oil.

Dr. A. K. Fisher, in charge of economic investigations, is credited with the discovery. Walking through the National Zoo, with a sprig of catnip in his pocket, he noticed that a mountain lion woke up when he passed by and that a tiger next door, reputed to be dangerous, seemed to be courting his friendship. It minced up to the bars and tried to follow him.

Dr. Fisher tossed the catnip over the fence. The tiger purred and sniffed and rolled over on it, licked the fur where it had touched, located the sprig on the floor, pounced upon it and finally ate it up. He reported this singular conduct to the survey and an investigation was begun to determine whether the plant could be used effectively as bait. The fact that oil of catnip was not produced anywhere on a commercial scale at first delayed the experiments. The Bureau of Chemistry reported that only minute quantities had ever been extracted, but a small amount was finally procured from which it was determined that the oil carried the characteristic odor and that this odor would persist for several months in the open air.

A catnip garden was then planted on the Experiment Farm at Arlington, from which enough oil was secured for field experiments. These proved so successful that additional crops were planted by the government at Saratoga Springs, New York.

Some hunters have reported taking every "cat" that came within the vicinity of traps baited with the catnip and the result is that the oil is now being distributed and used on a large scale.

NEW SCIENTIFIC BOOKS

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COMPARATIVE MORPHOLOGY OF FUNGI. Ernest A. Gaumann. Translated and revised by Carroll W. Dodge. pp. xiv + 701. Illustrated. $7.50.

The introductory chapters contain a discussion of the most important points of view and the basic forms, assuming previous knowledge of a text-book. The last part of the book describes modifications of the basic forms.

Macmillan Company, New York

HUMAN VALUES AND VERITIES. Henry Osborn Taylor. pp. xiv + 282. $2.75.

Some chapters are: The functioning of faculty; Human values; Human validity; Values and validity in history; Cleavage between science and philosophy; Philosophy's validity and value; The imaginative arts; Art's value and verity; The active life.

Geological Survey of China, Peking

Palaeontologia Sinica

FUSULINIDAE OF NORTH CHINA. Series B, Volume 4, Fascicle 1. Jonquei S. Lee. pp. vii + 172. 24 plates, 21 figures.

Discusses the distribution of fusulinidae in North China, gives the terminology of the common structural elements in boultonia, fusulinella and fusulina and describes the various species contained within these groups.

REVISED DETERMINATIONS OF SOME TERTIARY MAMMALS FROM MONGOLIA. Series C, Volume 5, Fascicle 2. Gerrit S. Miller, Jr. pp. vi + 20.

Some of the mammals described are: scaptochirus primaevus; crocidura kormosi; hyaena; martes anderssoni; aplodontia asiatica; allactaga wimani.

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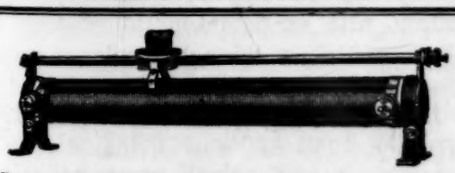

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Last year 246 lions, 3,677 bobcats and 41 Canada lynxes were taken by hunters employed by the Biological Survey and, while some of these were probably caught by the old method, hundreds were victims of their taste for catnip.

CHILDREN'S READING HABITS

THE extent to which a child buries his nose in his book when he reads or studies is determined to a considerable extent by his imitation of other readers that he sees. This is the belief advanced by E. B. Notson, of the University of Arkansas, in a report to *School and Society*.

From measurements made during two years, Mr. Notson concludes that the average first grader holds his primer about eight inches from his eyes. This distance increases rather steadily a little less than an inch a year until at high-school age he is holding his Latin book and his algebra thirteen inches away. After that, there is only a small and slow increase to manhood.

The change in distance can not be attributed to the chief ocular features involved, which are accommodation and convergence. "The most influential factor seems to be imitation. Children imitate the reading posture of older children and adults and consequently, as they grow, their books naturally grow farther from their eyes until adolescence, when both physical growth and reading distance slow up and eventually become stationary. Such an explanation may at first seem absurd, but when all the data are in this conclusion will be inevitable."

Measurements made by Mr. Notson are cited as showing that the usual recommendation for children to hold their books 14 inches away is actually very little followed. Whether the normal tendency of children to hold their books closer to the eyes is best for the children's sight is yet to be determined.

EXPEDITION TO RUSSIAN TURKESTAN

FRAGMENTS of a lost race of white men, marooned on lofty mountain ranges in interior Asia among a sea of Mongol folk, are among the objectives of an expedition participated in by German, Austrian and Russian scientists. The group goes into territory hitherto never explored by Europeans, under the leadership of W. Rickmers, of Bremen, who conducted a German expedition into Turkestan some years ago.

The mountain regions to be investigated are known as the Transalai and the Seltau. They are parts of the Himalaya uplift, lying to the northwest of the "roof of the world," in Russian Turkestan. Formerly they were lumped together under the name Pamir.

It is believed that their inhabitants are remnants of Indo-Germanic races, descendants of the stock that populated India and Europe. The theory is that they sought refuge in these mountains when the Mongols overran Asia during the Middle Ages, and have remained there ever since. One of the members of the expedition is a specialist in the structure of languages; he will try to gain some clue to the ancestry of the mountain folk from their speech.

Other members of the party will represent the sciences of geology, geography, meteorology and natural history. Four expert mountain climbers will accompany the party for the purpose of scaling the more difficult peaks and making a study of the high glaciers.

ITEMS

SOME of the dreaded after-effects of scarlet fever may be lessened by new tests developed by Dr. A. A. Osman, of Guy's Hospital, London. The cases of scarlet fever that are likely to develop kidney complications, one of the most serious of the consequences that scarlet fever leaves in its wake, can be detected by these tests in the early stages of the disease and preventive treatment administered in the shape of doses of simple alkaline compounds. The number of cases of kidney complications has been reduced by Dr. Osman by means of these methods from 5.5 per cent. in an untreated control group of 316 to .6 per cent. in a treated group of 620.

CHILDREN may have to welcome an undesired addition to the whooping cough and measles afflictions they have to undergo in the process of becoming grown up. Several cases of a new eruptive disease which does not fit into the category of either measles or German measles, though it resembles both, have broken out in Paris, according to reports received from the French correspondent of the American Medical Association. "The fifth disease," as French physicians have christened the new malady of children, does not provoke symptoms of a serious character though certain changes in the number of cells in the blood have been noted. Many of the children who have "taken" the disease have histories of both types of measles and of scarlet fever.

BIG predatory locusts, that prey on their own fellow-insects instead of on growing grain crops, are being tried out in Greece as one means of combatting the pest of ordinary locusts now threatening the fields, according to word received from Athens. These modern descendants of one of the plagues of Egypt have been causing serious losses to Greek agriculture during the past few years, and the Ministry of Agriculture is preparing to spend 16,000,000 drachmas (approximately $3,200,000) in a campaign against them.

A MACKEREL with an unbroken rubber band running over its back and right through the lower part of its body is the zoological puzzle recently examined and reported by Dr. E. W. Gudger, of the American Museum of Natural History. The fish was purchased on a market stall, so that its history is unknown. Dissection indicates that the band must have been snapped around the fish's body, and that its pressure and friction forced it upward through the tissues of the abdomen. These later healed shut beneath it, leaving it apparently "wove through" the living fish. Other mackerel have been reported with rubber bands placed around their tails by unknown persons, but this is the first case recorded where the band went through the body.